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October 23, 2012
Revised October 29, 2012

Ms. Verneta Simon, On-Scene Coordinator
US Environmental Protection Agency - Region 5
77 W. Jackson Blvd., SE-5J
Chicago, Illinois 60604-3590

RE: Interim Response Action Letter
Fill Soil Radiological Assessment and Compliance
164-166 E. Grand Ave, Chicago, Illinois

Dear Ms. Simon:

This Interim Response Action describes the fill soil radiological assessment and compliance activities that will be performed in response to the discovery of radiologically contaminated fill soil at the 164-166 E. Grand Avenue property located in Chicago, IL (referred to as “Site”). The intent of these activities is to conduct gamma screening to identify areas of radiologically contaminated fill soil within the existing trench along the western side of the building interior and within an existing soil stockpile inside the building. These actions will allow construction of the west wall footing to be completed as well as backfilling of the excavation adjacent to this foundation. Clean soil will not be placed until USEPA has been notified and USEPA has not prohibited the placement of clean soil. Currently, construction activities have been halted at the discretion of Old Veteran Construction until a gamma screening program approved by the United States Environmental Protection Agency (USEPA) can be implemented. A forthcoming plan will describe additional site activities and procedures related to radiological compliance for the continuing construction activities associated with this project.

BACKGROUND

The USEPA, via City of Chicago permits, requires radiological screening for designated Streeterville properties and rights-of-way during all subsurface earthwork activities. The initial surface gamma survey of a sub-slab portion of the Site was conducted by Huber Consultants, Inc. on October 3, 2012. This survey observed elevated gamma readings that are indicative of radiological contamination within the trench and at a single spot at the surface of the existing soil pile. In a meeting held with USEPA on October 17, 2012, AECOM discussed the findings from the earlier radiological investigation, potential actions required by the USEPA for the identified thorium contaminated fill soil, and the proposed plans for dealing with the apparent contamination and proposed gamma screening procedures that will be necessary in order to restart construction. This letter summarizes the discussions held in the meeting and provides a description of interim actions to be implemented in conjunction with the construction.

INTERIM ACTIONS

As described above, construction activities have been halted at the site until a gamma screening and contaminated soil program can be implemented pursuant to an agreed order. Currently, soil that was excavated during test pit and trenching activities along the western property edge is stockpiled along the eastern interior wall of the building. The excavation work that created the stockpile was performed to get the construction permits necessary for the future construction activities, which are necessary for the remodeling of the existing building. This interior soil stockpile impedes logistics and limits site activities due to space constraints. After gamma screening and containerizing of any radiologically contaminated soil, clean stockpiled soil may be used as backfill in order to pour the footing/cap for the western wall. However, this soil cannot be removed or used as backfill until being assessed for radiological compliance.

The following sequence of activities will be implemented to reinitiate construction. Pouring of the concrete cap and footings (Step 4) may be conducted prior to backfilling of the trench as long as the concrete work can be accomplished without the disturbance of contaminated soil. Each of the activities is briefly discussed below.

1. Sawcutting of Existing Slab – Sections of the existing slab along the trench that have been undermined will be sawcut and removed. This is necessary to allow safe entry into the trench to complete the trench gamma survey. In addition a relatively straight edge will be required in order to properly re-pour and match the existing slab. If the base of the trench cannot be surveyed before sawcutting, plastic sheeting or tarps will be stretched/placed beneath the overhanging slab sections to prevent cross-contamination of the concrete by potentially contaminated soil and allow safe retrieval of the concrete pieces.

2. Trench Gamma Survey – A gamma survey will be completed and a drawing will be produced that indicates locations within the existing trench that exceed the radiological cleanup threshold (7.1 pCi/g for the Streeterville area). Soil screening procedures that will be employed at the site are described below.

   Barrier/marker Installation – If any material exceeding the cleanup threshold of 7.1 pCi/g is proposed to be left undisturbed in the sidewall or floor of the trench, USEPA will be notified by email and phone and both the shielded and unshielded highest gamma readings of the contaminated material proposed to be left in place will be reported. Depending upon the location and gamma level or soil concentration, USEPA may determine that the contaminated material must be excavated. Based on the gamma survey results, landscape fabric or heavy plastic sheeting will be used to cover areas exceeding the field instrumentation cleanup threshold within the existing trench. The sheeting material will serve as a barrier to limit worker exposure/direct contact with contaminated soils as well as further minimize the potential generation of contaminated dust. Backfill will subsequently be placed on the fabric/plastic sheeting within the trench (see item #4 below). The fabric/sheeting will also act as a marker for future excavation, which is not anticipated to complete the planned construction activities. Areas where contaminated material has been identified but not removed/excavated will have the dimensions of their extent and location and the highest gamma readings and/or soil concentration noted in institutional controls documentation for future reference.

3. Trench Backfilling – Any material from the stockpile exceeding the field instrument threshold equivalent to the cleanup threshold of 7.1 pCi/g will be placed into a super-sack for subsequent characterization, removal and disposal. The trench will be backfilled with the clean stockpiled soil, which originated from the trench, and likely capped with a layer of CA6 stone. Soil from the stockpile will be screened prior to utilizing it as backfill. After backfilling, construction of the footing and wall along the western edge of the property will be initiated. The following activities will be performed concurrent with trench backfilling:

   - sampling of bagged material for laboratory analysis to confirm field gamma screening results and to assess if material to be shipped for disposal as radiologically-contaminated soil exhibits hazardous waste characteristics per RCRA;
   - water (via spraying) will be used to control dust during stockpile screening and backfilling activities;
   - personnel air monitoring will be performed for workers involved directly in trench surveying, soil pile screening, and backfilling activities;
   - gamma screening of the trench and soil stockpile will be performed using a shielded 2 x 2 probe;

4. Foundation Cap/Footing Installation – The foundation cap/footing will be poured after trench backfilling has been completed unless it is feasible to pour it before trench backfilling. Concrete work would only be completed first if no disturbance of contaminated soil would be necessary to complete the concrete cap and footing work.

5. Interior Surface/Slab and Exterior Park Lot Surveys – The building interior slab and exterior parking lot will be gamma screened using surface screening methods outlined below and a drawing created with the results.

METHODS

Applicable Cleanup Standard

Based upon 40 CFR 192, the USEPA has set the cleanup level as 5 pCi/g total radium (Ra-226 and Ra-228) above the background. A level of 2.1 pCi/g total radium is currently considered background for the Streeterville Investigation Area by the USEPA. Thus, radiologically-contaminated material is defined by the USEPA for the Streeterville Investigation Area as exceeding a threshold of 7.1 (pCi/g) total radium.

Field measurements will be taken of gamma radiation levels using a Ludlum 2221 scaler-ratemeter and a 2 x 2-inch sodium iodide (NaI) detector. The equipment will be calibrated to determine the gamma count in counts per minute (cpm) that is equivalent to 7.1 pCi/g. Equipment calibration will be performed at least annually using the thorium calibration blocks at the former Tronox West Chicago Rare Earth Facility.

Prior to the initiation of activities, gamma count rate background levels shall be established for each applicable survey instrument. Three locations shall be chosen in non-radiologically-contaminated areas of the Site. A one-minute integrated count shall be obtained at the surface of each location, for each survey instrument (Ludlum 2221 with 2” x 2” NaI probe). The measurements collected from each location shall be averaged to establish instrument specific background gamma count rates.

Gamma Screening Procedures

Screening will be performed in accordance with the applicable procedures as outlined in SOP-210. Gamma screening of the stockpile will be performed using a shielded 2 by 2-inch sodium iodide (NaI) gamma detector and a Ludlum Model 2221 scaler-ratemeter calibrated to the thorium calibration blocks at the former Tronox West Chicago Rare Earth Facility. Values will be recorded in cpm. The shielded probe is necessary for work within the building because the brick in the walls is making unshielded screening difficult by contributing appreciable background gamma. Higher gamma readings from brick material is not uncommon and is considered natural background due to the brick’s clay content. The Stan A. Huber report of October 3, 2012 indicated that the on-contact unshielded gamma count for the interior brick walls ranged from 15,500 to 17,500 (instrument threshold equivalent to 7.1 pCi/g was 19,110 cpm).

The surface of the stockpiled soil will be initially screened and subsequently screened in 18-inch intervals or lifts. Based on the gamma survey results, the material will either be designated as “clean” and used as soil backfill or “contaminated” and immediately containerized in a super-sack for later transportation and disposal.

Trenches and any exposed surface soil will be screened using a walk-over survey methodology using a shielded 2 x 2-inch probe. Surface surveys of interior slab will be conducted using a Ludlum 2221 scaler-ratemeter and a shielded 2 x 2-inch NaI gamma detector. If radiologically-contaminated soil in excess of the Applicable Cleanup Standard is identified these areas will be designated as Exclusion Zones i.e., access restricted until a barrier (i.e., landscape fabric, plastic sheeting and/or soil) is installed to prevent direct contact with the contamination. As described in the attached Health and Safety Plan (HASP), unless a barrier is in place, Exclusion Zones will require appropriate PPE and personal air monitoring to enter. All equipment and personnel that enter an Exclusion Zone will be surveyed to verify they are clean upon leaving the Exclusion Zone. Personnel entering Exclusion Zones must be 40-hour health and safety trained.

Survey of the surface of the exterior paved parking lot will likely be able to be performed with an unshielded probe. Values will be recorded in counts per minute (cpm). The maximum value will be recorded for each grid cell and all anomalously high areas (two times the background concentration) will have the approximate limits designated on the survey data sheets. The locations will be marked in paint on the ground surface. Field screening data sheets will include recording the instrument serial number, calibration date, operator, and site grid coordinates surveyed. A grid with a 5-meter spacing will be marked by flagging at the edges of the Work Area or by paint on the ground surface within the Site. The areas between the grid points will be scanned so as to cover 100 percent of the intra-grid areas. The interior slab survey will utilize identical methods except that a shielded probe will be used to complete the survey.

Materials Management

Soil from the Site that is not radiologically-contaminated above the Applicable Cleanup Standard may be replaced in their original locations. If not needed as backfill, soil that is not radiologically-contaminated above the Applicable Cleanup Standard may be designated to be removed from the Site and will be disposed of in accordance with applicable regulations as necessary. Soil contaminated above the Applicable Cleanup Standard will be temporarily stored on-site in super-sacks pursuant with USEPA approval. Soil that is contaminated above the Applicable Cleanup Standard will ultimately be sent to an appropriate commercial disposal facility. However, off-site shipment of material in not planned as part of this initial interim action.

Decontamination

All discarded materials, waste materials, and other field equipment and supplies will be handled in such a way to prevent the potential spread of contamination during excavation and restoration activities. Discarded items that have contacted contaminated materials will be containerized and stored for disposal at the permitted commercial disposal facility. Non-contaminated items to be discarded will be collected for disposal as general refuse waste.

HEALTH AND SAFETY PLAN (HASP) SUMMARY

A USEPA Streeterville HASP is attached. Survey activities will be conducted in accordance with the Site HASP. The HASP addresses required training, personnel protection equipment, general work precautions, and medical monitoring among other issues. In general, as radiologically-contaminated soil above the Applicable Cleanup Standard is detected the areas will be designated as Exclusion Zones and will require appropriate PPE and personal air monitoring to enter. All equipment and personnel that enter an Exclusion Zone will need to be frisked/surveyed to verify they are clean upon leaving the Exclusion Zone. Personnel entering Exclusion Zones must be 40-hour health and safety trained.

Potential Hazards

Potential hazards that could be encountered during the removal activities include contact with contaminated materials and the hazards associated with construction work. Contaminants of concern include the entire decay series for U-238 and Th-232. Radiological and air monitoring as described in this letter will be performed during excavation to define the presence of radiological contaminants.

The mechanisms for exposure to the radiologically-contaminated soil material are direct exposure, inhalation, ingestion and eye/skin contact. The primary mechanism of exposure is direct exposure to external gamma radiation. Workers will be instructed in appropriate measures to protect against exposure to the above materials, and PPE will be worn until monitoring shows PPE is not necessary.
Physical hazards which might be encountered at this Site include but are not limited to the following:

Construction equipment (front-end loaders, track excavators, trucks, compactors, bulldozers);
Power tools (saws, drills, jack hammers, compactors);
Heat and cold stress;
Overhead power lines;
Excavations;
Confined space;
Noise;
Demolition of structures;
Slip, trip and fall conditions, especially during wet or freezing periods; and
Buried utilities which may or may not be live.

Additional details on these and other safety provisions are addressed in the HASP.

Training and Communications

Site and project specific radiation and health and safety training will be provided for all on-site personnel prior to work on the Site. All personnel required to work in the Exclusion Zone or Contamination Reduction Zone will complete training conforming to the requirements of 29 CFR 1910.120(e) including 40-hours of initial hazardous waste site worker training. Where appropriate, they will have 8-hours of annual refresher training, and 8-hour supervisor training as appropriate.

All site personnel will be trained and briefed on radiation basics, anticipated hazards, equipment to be worn, safety practices to be followed, contamination prevention practices, emergency procedures, radiation basics and communications. Procedures for leaving the Exclusion Zone shall be planned and implemented prior to going on-site. Work Areas and decontamination procedures will be established based on expected site conditions, and updated as necessary during construction. Other guidelines such as heat and cold stress, excavation safety and confined space are included within the HASP.

In addition to this formal health and safety training, “tailgate” safety meetings will be held daily, or more frequently, dependent on safety issues arising during the project. These meetings may be led by the field team leader or the worker's foremen and every employee must sign in before beginning work. The subject covered and persons present will be recorded for each meeting and kept as part of the project records. Health and safety incidents and monitoring results will be discussed in the tailgate safety meetings, when appropriate.

Visitors to the Site will be briefed on the requirements of the HASP before being allowed within the Work Area, and will be accompanied by a foreman or supervisor whenever possible.

Personal Protective Equipment

Disposable coveralls, steel-toed work shoes, boot covers, hard hat, safety glasses and gloves will also be required in all Exclusion Zones. Prior to exiting any Exclusion Zones, personnel will pass through decontamination, disposal of all appropriate PPE, and frisking/surveying procedures as described in the HASP. Personnel operating in Exclusion Zones will be required to have personal air monitors (PAMs).

Air Quality - Personal Exposure Monitoring

Air monitoring is generally conducted for the purpose of documenting and, if detected, initiating measures to control airborne contamination. If the volume of contaminated soil that will be excavated is minimal (measured in yards rather than hundreds of yards), the potential to create a fugitive dust issue is reduced significantly. The activities being undertaken are primarily the screening and backfilling of the existing excavations. Excavation and/or remediation of in-place contamination is not planned. Therefore, the only potential handling of contaminated soil during this initial response action will occur during the screening of the existing stockpiles.

The principal objectives of the air monitoring activities are to:

- Ensure worker and general population safety and provide radiological control information;
- Evaluate work procedures and site control measures. In addition to identifying the need for corrective action, air monitoring also documents the effectiveness of such control actions; and
- Measure releases of airborne radioactivity (should any occur) and ensure that people working in the area are not exposed to radiation above acceptable limits.

A primary requirement of dust control is “no visible dust” during activities associated with contaminant removal. Soil handling areas where contaminated soil may be present will be required to have no visible dust. Fugitive dust generation may be caused by a range of activities including excavation, loading and dumping. Since the interior soil stockpile is relatively dry, water will be applied during the course of excavation and handling activities to prevent, mitigate or reduce dust.

Personnel operating in Exclusion Zones will be required to have personal air monitors (PAMs). Procedures for personal air monitoring are discussed in the HASP and SOP-212. Lapel samplers worn for personal air monitoring will be utilized for airborne radioactivity monitoring. Air filters will be analyzed on a daily basis and additional evaluation of samples will be performed when determined necessary based on elevated results.

Radiologically-contaminated soil from the soil stockpile above the Applicable Cleanup Standard will be loaded directly into the super-sacks to eliminate future potential contaminated dust generation as the material is identified. This contaminated soil will be stored on-site in labeled super-sacks.

COMPLETION DOCUMENTATION

An objective of this action is to document the screening activities, as well as the identification and handling of radiologically-contaminated soil should it be encountered during these initial activities. The following types of data will be generated during the project:

Surface gamma survey records;
Soil sampling records (if performed);
Fixed laboratory soil analyses data, if performed (AECOM subcontract laboratories); and
Air quality (personnel) sampling/analytical records.

The results of the initial investigation work will be presented in a short letter report. The report will provide a summary of surveyed portions of the Site and locations of radiologically-contaminated material remaining above the Applicable Cleanup Standard. The report will include field data, laboratory results, documentation of the volume of material removed and its disposal location. The draft report will be submitted within 60 days of completion of the work and on-site investigations. AECOM will incorporate U.S. EPA's comments, if any, and submit the final report within 15 days of receiving U.S. EPA's written comments, if any, on the draft report.

Should you have any questions with regard to this Interim Action Letter, please contact the undersigned at (847) 279-2500. We thank you again for your cooperation and rapid response as we initiate this project.

Yours sincerely,

AECOM Technical Services, Inc.

Steve Kornder

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Attachments:

SOPs 210 and 212
USEPA Streeterville HASP

cc:

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C. Martwick, USEPA
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164-166 EAST GRAND AVE
CHICAGO, IL 60611

STANDARD OPERATING PROCEDURE

Title: Gamma Radiological Surveys

Document: SOP-210

Revision Number:

Date: October 23, 2012 Replaces: New

GAMMA RADIOLOGICAL SURVEYS

1.0 PURPOSE

This procedure provides protocols for conducting gamma radiological surveys for potentially contaminated soil and/or fill material.

2.0 SCOPE

Radiological surveys will be performed at the designated Site as part of the surface screening, excavation, and verification surveying programs.

3.0 REFERENCES

- NUREG 1507 – *Minimum Detectable Concentrations With Typical Radiation Survey Instruments for Various Contaminants and Field Conditions*
- NUREG 1575, Rev. 1 - Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)

4.0 EQUIPMENT AND MATERIALS

The following equipment may be used as part of the survey programs. Other equipment may be substituted if necessary because of availability of the items listed or the conditions encountered at the site.

- Trimble Pathfinder Pro XR 4.1 global positioning system (GPS), or equivalent (optional).
- Ludlum Model 44-10 2 x 2 inch sodium iodide (NaI) (Tl) gamma detector.
- 6-inch collimated lead shield for detector.
- Ludlum Model 2221 portable scaler ratemeter analyzer.

5.0 INSTRUCTIONS FOR RADIOLOGICAL SURVEY

5.1 Establishment of Background Gamma Count Rate

5.1.1 The gamma count rate background levels shall be established for each applicable survey instrument. Six randomly selected locations of similar media (i.e., paved, landscaped, etc.) shall be chosen in non-radiologically impacted areas of the Site. A one minute integrated count shall be obtained at the surface of each location for each survey instrument (Ludlum 2221 with 2 x 2 in NaI probe). The measurements collected from each location shall be averaged to establish an instrument specific background gamma count rate.

5.2 Land Surface Survey Procedure - Manual

5.2.1 Establish a Grid Network

5.2.1.1 Two perpendicular baselines will be established.

5.2.1.2 A grid along the baseline will be established using cloth or steel tape and a compass, if necessary. Stakes, survey flags, or paint will be placed as needed to delineate grid or traverse lines. The grids will be spaced about twenty feet apart.

5.2.1.3 The baseline, permanent structures, areas of remediation, and other areas of interest will be illustrated in the field logbook.

5.2.2 Gamma Survey Procedure – Manual Data Recording

5.2.2.1 The Ludlum ratemeter is set for 2 second time-weighted average count rate.

5.2.2.2 Hold the survey meter probe base parallel to the ground surface at a height as close as practical and not more than 3 inches from the ground surface. Note: It is important to keep the meter at a consistent height since counts will vary with the distance from the surface.

5.2.2.3 Walk along grid lines at a maximum speed of about 0.5 meters per second (1 mile per hour). Grid will be traversed with a serpentine pattern, spaced 3 feet apart.

5.2.2.4 Identify locations with count rates greater than twice the background count rate and record them or the Radiation Survey Form – Surface Gamma Scan.

5.3 Land Surface Survey Procedure – Continuous Data Logging with GPS

5.3.1 Gamma Survey Procedure

5.3.1.1 Position the survey meter probe base parallel to the ground surface at a height as close as practical and not more than 3 inches from the ground surface. Note: It is important to keep the meter at a consistent height since counts will vary with the distance from the surface.

5.3.1.2 Traverse the survey area at a maximum speed of about 0.5 meters per second (1 mile per hour). The survey area will be traversed in a serpentine pattern, spaced 3 feet apart.

5.3.1.3 Ludlum and GPS equipment will be interfaced with a computer/data logger that will collect gamma surface readings, and the associated GPS coordinates, at two second intervals.

5.3.1.4The GPS coordinates and gamma survey results will be plotted with locations exhibiting gamma count rates greater than twice background highlighted.

5.4 Radiological Survey of On-Site Materials

5.4.1 Material that is excavated and placed in the clean stockpile will be surveyed two times. The first survey will be performed prior to excavation activities, if the excavation can be entered safely.

5.4.2 The second survey will be performed during the excavation of the non-contaminated soil.

The soils will be surveyed before they are placed in the stockpile. Based on the gamma scan, the material will either be designated as contaminated material and immediately loaded for transportation and disposal or tentatively designated as clean and stockpiled for subsequent soil sampling per Standard Operating Procedure (SOP)-214.

5.5. Daily Surveys

5.5.1 Routine daily surveys shall be performed for each day of operations at the site.

5.5.2 The routine surveys will monitor areas in the immediate vicinity of excavations and along soil movement paths to ensure that radiation levels are not affected by activities.

5.5.3 Routine surveys shall be documented by preparing a drawing of the survey results in the field logbook, indicating either the location and value of individual measurements, or contours of the measured gamma field.

5.5.4 Surveys of excavation areas will be made at the request of the Field Team Leader to assess the progress of the removal. These surveys will not be documented, but will be used by the Field Team Leader to manage the excavation.

5.6 Pre-Verification or Verification Survey

5.6.1 Upon completion of remediation excavation activities, either a pre-verification survey shall be performed to ensure that the excavation is ready for a final verification survey by regulatory authority (i.e., United States Environmental Protection Agency (USEPA) and/or Illinois Environmental Protection Agency (IEMA)) or a verification survey shall be performed to ensure that the excavation is ready for backfill based on the approval of the regulatory authority.

5.6.2 The survey is conducted at the same time as the excavation work phase. The survey method is performed as specified in Sections 5.2 and/or 5.3. Upon completion of the survey and excavation phase, a Notification of Successful Pre-Verification or Verification is sent to the regulatory authority requesting a final verification survey or approval to backfill.

5.7 Site Grading Survey

5.7.1 Surveys will likely be conducted prior to or at the same time as the grading activities and will be performed as specified in Sections 5.2 and/or 5.3 of this SOP.

5.7.2 The corners or boundaries of the area to be surveyed will be tied into a site-wide coordinate/survey network. Stakes, survey flags, or paint will be placed along the boundaries of the survey area using a cloth/steel tape or wheel at approximately 20 foot intervals to subdivide the area into 20 x 20 foot areas.

5.7.3 Each 20 x 20 foot area will be traversed using a line spacing of approximately 4 foot. Readings greater than twice background will be painted and flagged for further investigation.

5.7.4 The maximum gamma count and readings over twice background will be recorded on the radiation survey form for site grading. Permanent structures and other issues of interest also will be included on the radiation survey form.

5.8 Caisson Construction Radiological Surveying

5.8.1 Procedures for Caisson Probe Test Pits. Note: These procedures will only be implemented if caissons are to be constructed at the Site.

5.8.1.1 The ground surface will be surveyed for elevated gamma radiation prior to beginning excavation. Excavation monitoring will include three survey efforts: 1) surveys of the excavation walls and floor until native sand is encountered, 2) surveys of the excavated fill while still in the excavator bucket, and 3) surveys of the excavation spoil pile.

5.8.1.2 Excavation will proceed in lifts not to exceed 18 inches per lift. The excavation walls and floor will be surveyed at each 18 inch lift until native sand is encountered. Additionally, the excavation spoil pile will be surveyed as excavation proceeds. Appropriate sloping of the test pit walls will be required to allow safe access for persons to enter the excavation for surveying the walls and floor. If the excavation is of such a dimension to preclude safe access of personnel to survey the walls and floor, the excavator bucket may be used to collect representative material from test pit and place the material in a spoil pile. Surveys of the spoil pile may be used to characterize the in-place material.

5.8.1.3 If elevated gamma radiation measurements are noted, equal to or exceeding twice the background gamma count, the excavation will proceed in thinner lifts, 6 to 12 inches. If the excavated fill exceeds the applicable cleanup standard, the radiologically-impacted fill will be staged on plastic separate from the clean soil and the pile will be marked with radiation rope. Alternatively, the impacted fill will be loaded directly into a Baker type box or super-sack.

5.8.1.4 Excavation equipment that has contacted radiologically-impacted fill will be surveyed with a Ludlum Model 3 Pancake Probe for elevated radioactivity. Indications of elevated radioactivity will require decontamination in accordance with the Work Plan SOP 347, Decontamination. Equipment in contact with the radiologically-impacted fill will be documented as clean through a swipe survey and alpha radiation count using the Ludlum Model 220 and Model 43-10 Alpha counter, in accordance with the Work Plan SOP 345, Survey for Surface Contamination and Release of Equipment for Unrestricted Use.

5.8.2 Procedures for Surveying during Caisson Installation

5.8.2.1 Areas previously screened to native soil will not be resurveyed. Auger spoils from caisson borings through unscreened fill (including fill from below the groundwater table) will be screened after the materials are removed from the borehole.

5.8.2.2 When practical, spoil on the caisson augers will be screened before being spun off. If the field screening indicates elevated gamma measurements, the auger spoil will be spun off onto an area covered with plastic to temporary contain the material for later placement in containers for offsite transport and disposal. Clean fill will be spun off and handled as appropriate for soil management.

5.8.2.3 Management of impacted fill during caisson construction will consist of the following. Radiation-trained laborers or excavating equipment will place that fill into approved containers (Baker type boxes or super-sacks, depending on apparent volume).

5.8.2.4 Prior to moving to a new location the Health Physics Technician will release the auger and other equipment that may have come in contact with impacted fill using SOP-345. Decontamination procedures are outlined in the Work Plan SOP 347.

5.8.3 Required Documentation

5.8.3.1 Caisson locations found to contain impacted fill and will be recorded. The background gamma count and maximum gamma radiation reading will be noted, along with the equipment specific threshold indicative of 7.1 pCi/g total radium and the depth at which the impacted fill material was encountered. Records will also identify any samples taken, the person(s) conducting the monitoring, the date the work was started and completed, and equipment serial numbers.

164-166 EAST GRAND AVE
CHICAGO, IL 60611

STANDARD OPERATING PROCEDURE

Title: Air Monitoring Procedure

Document: SOP-212

Revision Number: 0

Date: October 23, 2012 Replaces: New

AIR MONITORING PROCEDURE

1.0 INTRODUCTION

The Air Monitoring Procedure provides for measuring the concentration of radioactive airborne dust that could be generated and emitted into the atmosphere as a result of the excavation, moving, and loading activities planned at the Site. The objectives of data collection for air monitoring activities are as follows:

- Collect airborne radioactivity data for the purpose of determining the exposure of workers participating in Site activities to airborne particulates
- Collect airborne radioactivity data to measure releases of airborne radioactivity to the environment and ensure that people living and working in the surrounding areas of the Site are not exposed to radiation above acceptable limits
- Collect airborne radioactivity data to evaluate work procedures and Site control measures for the purpose of keeping exposures to both workers and the general public as low as reasonably achievable (ALARA).

2.0 REGULATORY REQUIREMENTS AND ADMINISTRATIVE LIMITS

As specified in 10 Code of Federal Regulations (CFR) Part 20 (unless more restrictive in 32 Illinois Administrative Code (IAC) 340) the licensee must demonstrate compliance with the dose limits for individual members of the public. The Site Air Monitoring Plan is based on being able to demonstrate that the average concentrations of radioactive materials in gaseous and liquid effluents at the boundary of the unrestricted area do not exceed the limits specified in Table 2 of Appendix B to 10 CFR 20. The radionuclides in the thorium and uranium series that could potentially be encountered during Site activities are listed in Table 1 of the Air Monitoring Plan. Th-232 has the most restrictive concentrations for both the Derived Air Concentration (DAC) and Air Effluent Limits.

Th-232 Class W DAC=$5x10^{-13}\mu$Ci/ml Air Effluent=$4x10^{-15}\mu$Ci/ml

Both worker exposure to airborne particulates and effluent release limits will be based on Th-232.

3.0 AIR MONITORING EQUIPMENT AND MATERIALS

- Staplex Model TFIA High Volume Air Samplers (or equivalent)
- Gilan Model BDXII Low Volume Personal Air Sampler (or equivalent)
- Staplex Model TFA810 “Ashless” Filter Papers – 95% collection efficiency of 1 micron particles. Effective efficiency of 70% (penetration absorption 30%)
- Zefon Model 739 MCE Filter Cartridges – 37 millimeter (mm) x 0.8 micrometer (μm) membrane filters
- Ludlum Model 2200 Scaler w/ Model 43-10 alpha scintillation detector
- Radiological Air Sample Data Form – Area Monitors, Form Standard Operating Procedure (SOP) 212-10
- Radiological Air Sample Data Form – Personal Air Monitors, Form SOP 212-11

4.0 SITE AIR MONITORING PROCEDURE

4.1 Background Air Quality

One downwind, high volume air sample shall be collected for a minimum of forty hours (five eight-hour days) prior to the commencement of excavation activities. This sample shall be analyzed the day after collection and then again after four days to allow for the decay of short lived radon and thoron daughters. The count, after four days decay, will serve as the official measurement of the background airborne alpha concentration. Future results during Site operations should be compared to this value to see if further engineering controls or procedural changes are warranted.

4.2 Perimeter Air Monitoring – High Volume Samplers

Four air monitoring locations shall be used during all excavation activities. These monitoring units will be at the property boundary or no more than 200 feet from the limits of the areas anticipated to be excavated. Samples shall be collected during all operations where potentially contaminated soils are being excavated, moved, or loaded. One monitor shall be placed on each perimeter of the site (North, South, East, and West) and collect samples at a height between one and two meters (four and eight feet) above the ground. Monitors will be located so as to provide unobstructed air flow from the source to the monitors. Flow rate through air samplers shall remain between 20 and 60 cubic feet per minute. Air sample filters shall be collected and replaced daily and submitted to the laboratory for analysis. Samples analyzed from the perimeter high volume monitors shall be used to determine the amount of airborne radionuclides leaving the Site.

4.3 Personal Air Monitoring – Lapel Samplers (Low Volume)

All workers participating in Site activities that involve the excavation, movement, or loading of potentially contaminated soils within a radiological exclusion zone shall wear a Personal Air Monitor (PAM) to evaluate the air quality in the worker's breathing zone. The Health and Safety Coordinator may require that additional personnel wear PAMs if there is a potential for that worker to encounter airborne particulates during Site operations. Samples shall be collected the entire time a worker is inside the exclusion zone and the cumulative time recorded. Flow rate through air samples shall remain between 2 and 4 liters per minute. Air sample filters shall be collected and replaced daily and submitted to the laboratory for analysis. Samples analyzed from the PAMs shall be used to determine potential contributions to worker's dose from airborne radionuclides.

5.0 AIR SAMPLE ANALYSIS

The Th-232 decay series contains seven alpha-emitting nuclides: Th-232, Th-228, Ra-224, Rn-220, Po-216, Bi-212 and Po-212. Of these, the first three nuclides can be assumed to be in complete equilibrium. The noble gas Rn-220 (thoron) may be ejected from the original matrix by recoil from the alpha particle decay of Ra-224. The fraction of Rn-220 that is removed via emanation is dependent on several variables, and is assumed to range from 10% to 40%. The emanating fraction is assumed to be transported away from the original matrix. If 40% of the Rn-220 escapes, the activity of the Rn-220 and its three alpha-emitting progeny nuclides will be at 60% of the Th-232 activity. These four alpha-emitting nuclides produce a total of 3.35 alpha emissions per Rn-220 decay. Since the Rn-220 activity is 60% of the Th-232 activity, these four nuclides only emit the equivalent of two alpha particles per Th-232 decay. These two alphas when combined with the three alpha particles from the nuclides in full equilibrium with the parent result in the total emission of the five alpha particles. Thus, the Th-232 contribution will be one-fifth or 20% of the total alpha activity.

For the reasons stated above, gross alpha concentrations shall be divided by a factor of five to determine the air concentration of Th-232, which is the most limiting of the applicable air effluent concentration limits ($4x10^{-15}$ microCuries per milliliter (μCi/ml)).

5.1 High Volume Sample Analysis

A 1.75 inch diameter cutout shall be obtained from each 8 x 10 inch high volume sample collected. All data pertaining to the sample shall be included on the *Radiological Air Sample Data Form – Area Monitors* worksheet. This worksheet contains the calculations required to determine total sample volume and sample concentration.

Each sample shall be analyzed the day after collection for gross alpha concentration. The minimum counting time is 30 minutes for Th-Alpha. The "day after" count will serve as a comparison to identify high gross counts from the previous day. It is expected that naturally occurring radon and thorium daughters will interfere with analysis, so the sample must be reanalyzed in four days. Thoron (Rn-220), if present in significant amounts, will require up to four days to allow for the decay of its Pb-212 daughter (10.6 hour half life). The count, after four days decay, will serve to be the official measurement of Th-Alpha.

Th-232 is the most restrictive of the applicable radionuclides that may be present during Site operations. The Th-232 contribution will account for 20% of the total alpha activity, so each gross alpha count must be divided by five to determine Th-232 concentration.

Multiple concentration measurements improve both precision and detection capability. Although air samples shall be counted the following day (and again four days later), effluent releases shall be reported on a weekly basis using the following calculation:

Equation A.9 NUREG 1400

$$C_{avg} = \frac{\Sigma\, T_{s,I}\, C_i}{\Sigma\, T_s}$$

where C = effluent concentration in μCi/ml
T_s= duration of sample collection

Sample concentration shall be determined using the following calculation:

Equation 6.9 *NUREG 1400*

$$C = \frac{R_n}{EFKT_S Cf\,(5)}$$

Where: $R_n = R_g - R_b = T_g / N_g - T_b / N_b$
E = fractional filter efficiency
F = air flow rate through the air sampler, cm^3/min
Cubic feet per hour x 28.316 liters/cfh x 1000 ml/ liter
K = Counting efficiency in cpm/ μCi
T_s = duration of sample collection
Cf = collection vs. analyzed ratio: conversion factor = 0.035

** note: Cf is not part of original NUREG calculation. It has been added to account for the fact that we are only analyzing 3.5% of total filter (i.e., a 1.75 inch circle from an 8 X 10 inch filter minus the 0.3 inch border covered by the filter holding plate).

5 = Samples are analyzed for gross alpha activity. Gross alpha concentration is to be divided by five to determine Th-232 concentration

5.2 Personal Air Monitor Sample Analysis

Personal Air Monitor (PAM) samples shall be analyzed in the same manner as the high volume perimeters samples. The only exceptions are that samples may be collected over the course of one week and that calculations are performed on a different worksheet – *Radiological Air Sample Data Form – PAM's, Form SOP 212-11*.

The action level for airborne radioactivity shall be 30% of the Derived Air Concentration (DAC) for Th-232 (DAC=5×10^{-13} μCi/ml). When PAM analysis indicates that concentrations have reached 1.5×10^{-13} μCi/ml, Level C protection may be considered. It is not anticipated that airborne concentrations will reach this level. Engineering controls, such as wetting of soils, and procedural changes shall be implemented to keep airborne concentrations ALARA.

At the conclusion of the project, data obtained from PAM's shall be used to determine a dose from airborne radionuclides for each monitored worker.

6.0 INVESTIGATIONS AND CORRECTIVE ACTIONS

The Health and Safety Coordinator will perform investigations and responses consisting of one or more of the following actions in the event that Action Levels are exceeded:

- Verification of laboratory data and calculations.
- Analyze and review probable causes.
- Evaluate need for reanalysis or additional analysis on original sample.
- Evaluate need for resampling.
- Evaluate need for sampling of other pathways.
- Evaluate need for notifications to regulators
- Dose assessments/bioassays.

7.0 ATTACHMENTS

- Table 1 *Derived Air Concentrations (DACs) and Effluent Air Concentrations of Selected Radionuclides in the Uranium and Thorium Series*
- Minimum Detectable Concentration Calculation – Area Monitors
- Minimum Detectable Concentration Calculation – PAM's
- Radiological Air Sample Data Form – Area Monitors, Form SOP 212-10
- Radiological Air Sample Data Form – PAM's, Form SOP 212-11

TABLE 1

Derived Air Concentrations (DACs) and Effluent Air Concentrations of Selected Radionuclides in the Uranium and Thorium Series

Radionuclide	Class	10 CFR 20 DAC (μCi/ml)	10 CFR 20 Air Effluent (μCi/ml)
^{238}U	D w Y	$6x10^{-10}$ $3x10^{-10}$ $2x10^{-11}$	$30x10^{-12}$ $1x10^{-12}$ $6x10^{-14}$
^{234}Th	w Y	$8x10^{-8}$ $6x10^{-8}$	$3x10^{-10}$ $2x10^{-10}$
^{234}U	D w Y	$5x10^{-10}$ $3x10^{-10}$ $2x10^{-11}$	$3x10^{-12}$ $1x10^{-12}$ $5x10^{-14}$
^{230}Th	w Y	$3x10^{-12}$ $6x10^{-12}$	$2x10^{-14}$ $3x10^{-14}$
^{226}Ra	w	3x10-10	$9x10^{-13}$
$_{222}Rn$	With Daughters Removed With Daughters Present	$4x10^{-6}$ $3x10^{-8}$ or 0.33 of working level	$1x10^{-8}$ $1x10^{-10}$
^{214}Pb	D	$3x10^{-7}$	$1x10^{-9}$
^{214}Bi	D w	$3x10^{-7}$ $4x10^{-7}$	$1x10^{-9}$ $1x10^{-9}$
^{210}Pb	D	$1x10^{-10}$	---
^{232}Th	w Y	$5x10^{-13}$ $1x10^{-12}$	$4x10^{-15}$ $6x10^{-15}$
^{228}Ra	w	$5x10^{-10}$	$2x10^{-12}$
^{228}Th	w Y	$4x10^{-12}$ $7x10^{-12}$	$3x10^{-14}$ $2x10^{-14}$
^{220}Rn	With Daughters Removed With Daughters Present	$7x10^{-6}$ $9x10^{-9}$ or 1.0 working level	$2x10^{-8}$ $3x10^{-11}$
^{212}Pb	D	$2x10^{-8}$	$5x10^{-11}$
^{212}Bi	D w	$1x10^{-7}$ $1x10^{-7}$	$3x10^{-10}$ $4x10^{-10}$
^{228}Ac	D w Y	$4x10^{-9}$ $2x10^{-8}$ $2x10^{-8}$	$2x10^{-11}$ $8x10^{-11}$ $6x10^{-11}$
^{234m}Pa	w Y	$3x10^{-6}$ $3x10^{-6}$	$1X10^{-8}$ $9x10^{-9}$
^{235}U	D w Y	$6x10^{-10}$ $3x10^{-10}$ $2x10^{-11}$	$3x10^{-12}$ $1x10^{-12}$ $6x10^{-14}$
^{231}Pa	w Y	$6x10^{-13}$ $2x10^{-12}$	$6x10^{-15}$ $8x10^{-15}$
^{227}Ac	D w Y	$2x10^{-13}$ $7x10^{-13}$ $2x10^{-12}$	$1x10^{-15}$ $4x10^{-15}$ $6x10^{-15}$
^{227}Th	Y w	$1x10^{-10}$ $1x10^{-10}$	$5x10^{-13}$ $5x10^{-13}$

FORM SOP 212-10

RADIOLOGICAL AIR SAMPLE DATA FORM – AREA MONITORS

Equation:

Volume (V) = (Pump ml/min.) (Total Sample Time) (count/sample conversion)
Multiply Cubic Feet by 28.316 to Obtain Liters
Ml/min = (L/min.) (1000 ml/L)

SAMPLE COLLECTION

Sample #	Per. By	Date	Sample Start Time	Sample End Time	Total Sample Time	Cubic Ft/min. (CFM)	Count vs. Sampled Conv.	Total Sample Volume (ml)

Equation: Actual Activity = Activity (A) - Background (B)

$$\text{Activity (A)} = \frac{\text{(Net CPM) (1/Eff.)}}{\text{(V) (2.2 E + 6 dpm/uCi) (filter retention factor) (5)}}$$

Sample #	Cal. By	Date	Gross Counts	Net CPM	Detector Efficiency (EFF)	Sample Volume Analyzed (ml)	Sample Concentration (A)μCi/ml	Background Activity (B)μCi/ml	Actual Concentration μCi/ml
4-day recount									

Filter retention factor/absorption correction = 0.7 for Staplex 8x10 ashless paper filter
= 1.0 for 37mm PAM membrane filters

Note: Activity is divided 5 due to the Thorium daughters that are counted with an open window (gross alpha)

Conversion factor for volume analyzed vs. volume sampled for 1.75” diameter cut-out = 0.035

30 minute background count for ____________ is _____________ cpm
date

30 minute background count for ____________ is _____________ cpm
date

FORM SOP-212-11

RADIOLOGICAL AIR SAMPLE DATA FORM – PAM'S

Equation:

Volume (V) = (Pump liters/min.) (Total Sample Time in minutes) (1000 ml/liter)

Sample Collection

Person Wearing Monitor	Pump #	Sample #	Date	Sample Start Time	Sample End Time	Total Sample Time	Cubic liters/min. LPM	Total Sample Volume (ml)

Equation: Actual Activity = Activity (A) - Background (B)

$$\text{Activity (A)} = \frac{\text{(Net CPM) (1/Eff.)}}{\text{(V) (2.2 E + 6 dpm/uCi) (filter retention factor) (5)}}$$

Sample Analysis

Sample #	Cal. By	Date	Gross Counts	Net CPM	Detector Efficiency (EFF)	Sample Volume Analyzed (ml)	Sample Concentration (A)μCi/ml	Background Activity (B)μCi/ml	Actual Concentration μCi/ml

Filter retention factor/absorption correction = 0.7 for Staplex 8x10 ashless paper filter
= 1.0 for 37mm PAM membrane filters

Note: Activity is divided 5 due to the Thorium daughters that are counted with an open window (gross alpha)

30 minute background count for ____________ is ______________ cpm
date

30 minute background count for ____________ is ______________ cpm
date

MINIMUM DETECTABLE CONCENTRATION CALCULATION – PAMS

Sensidyne Personal Air Monitor Samples analyzed on Ludlum 43-10 Alpha Counter

$$\mathrm{MDC} = \frac{2.71}{n\,E\,F\,K\,T_g\,T_g} \qquad \frac{3.29\sqrt{Rb}\left[\frac{1}{Tb}+\frac{1}{Tb}\right]}{n^{1/2}\,E\,F\,K\,T_s}$$

n = number of sampling intervals
E = fractional filter efficiency
F = airlow rate through the sampler in cm^3/min
K = counting efficiency in cpm/μCi
T_s = duration of sample collection in min
T_g = gross counting time
T_b = background counting time
R_n = net count rate in cpm
R_b = background count rate in cpm
C = concentration of radioactive material in the air in μCi/cm^3

N = 5 days of sampling minimum per week
E = 1.0 37mm 0.8 μm MCE Filters
F = 2.5×10^3 cm^3/min (or ml/min)
2.5 liters per minute x 1000 ml/l = 2500 ml/min
K = 699300
0.315 count/disintegration x 2.22 x 106 dis/μCi = 699300 cpm/μCi
T_s = 480 min
Based on a minimum of 8 hours per day
T_g = 30 min
T_b = 600 min

Rb = 0.58 cpm, based on 3000 min background count on 9/16 – 9/20/02

$$\mathrm{MDC} = \frac{2.71}{(5)\,(1.0)\,(2500)\,(699300)\,(480)\,(30)} + 3.29\ \frac{\sqrt{(0.58)}\left[\frac{1}{(600)}+\right]\frac{1}{(30)}}{(2.24)\,(1.0)\,(2500)\,(699300)\,(480)\,(30)}$$

= 2.98×10^{-14} μCi/ml (gross alpha weekly MDC)
= 5.96×10^{-15} μCi/ml (gross alpha ÷ 5, for Th-232)

MINIMUM DETECTABLE CONCENTRATION CALCULATION

Sensidyne TFIA High Volume Air Samples analyzed on Ludlum 43-10 Alpha Counter

$$MDC = \frac{2.71}{n\ E\ F\ K\ T_g\ T_g} \qquad \frac{3.29\sqrt{Rb\left[\frac{1}{Tb}+\frac{1}{Tb}\right]}}{n^{1/2}\ E\ F\ K\ T_s\ cf}$$

NUREG 1400 Air Sampling in the Workplace Appendix A (eq A.17)

n = number of sampling intervals
E = fractional filter efficiency
F = airlow rate through the sampler in cm^3/min
K = counting efficiency in cpm/μCi
T_s = duration of sample collection in min
T_g = gross counting time
T_b = background counting time
R_n = net count rate in cpm
R_b = background count rate in cpm
Cf = count vs. sample conversion
(this is not part of NUREG 1400, however, analysis volume must be taken into account)

n = 5 days of sampling minimum per week
E = 0.7 (referred to as filter retention factor on air sampling form)
F = 1.13×10^6 cm^3/min (or ml/min)
40 ft^3/min x 28.316 liters/ft^3 x 1000 ml/l = 1.13×10^6 ml/min
K = 699300
0.315 count/disintegration x 2.22 x 106 dis/μCi = 699300 cpm/μCi
T_s = 480 min
Based on a minimum of 8 hours per day
T_g = 30 min
T_b = 600 min
Cf = 0.035
8” x 10” original filter size = 80 $inches^2$
0.3 inch border is covered by sampler plate and not sampled = 10.8 $inches^2$
filter cutout = $\pi r^2 = (0.875”)^2$ (3.14) = 2.41 $inches^2$
actual sample area = 80 $inches^2$ – 10.8 $inches^2$ = 69.2 $inches^2$
sample analyzed vs. sample collected ration = 2.41/69.2 = 0.035
r_b = 0.58 cpm, based on 3000 min background count on 9/16 – 9/20/02

$$MDC = \frac{2.71}{(5)\ (0.7)\ (1.13E6)\ (699300)\ (0.035)\ (480)\ (30)} + \frac{3.29\sqrt{(0.58)\left[\frac{1}{(600)}+\right]\frac{1}{(30)}}}{(2.24)\ (0.7)\ (1.13E6)\ (699300)\ (0.035)(480)\ (30)}$$

= 2.69×10^{-15} μCi/ml (gross alpha weekly MDC)
= 5.39×10^{-16} μCi/ml (gross alpha ÷ 5, for Th-232)